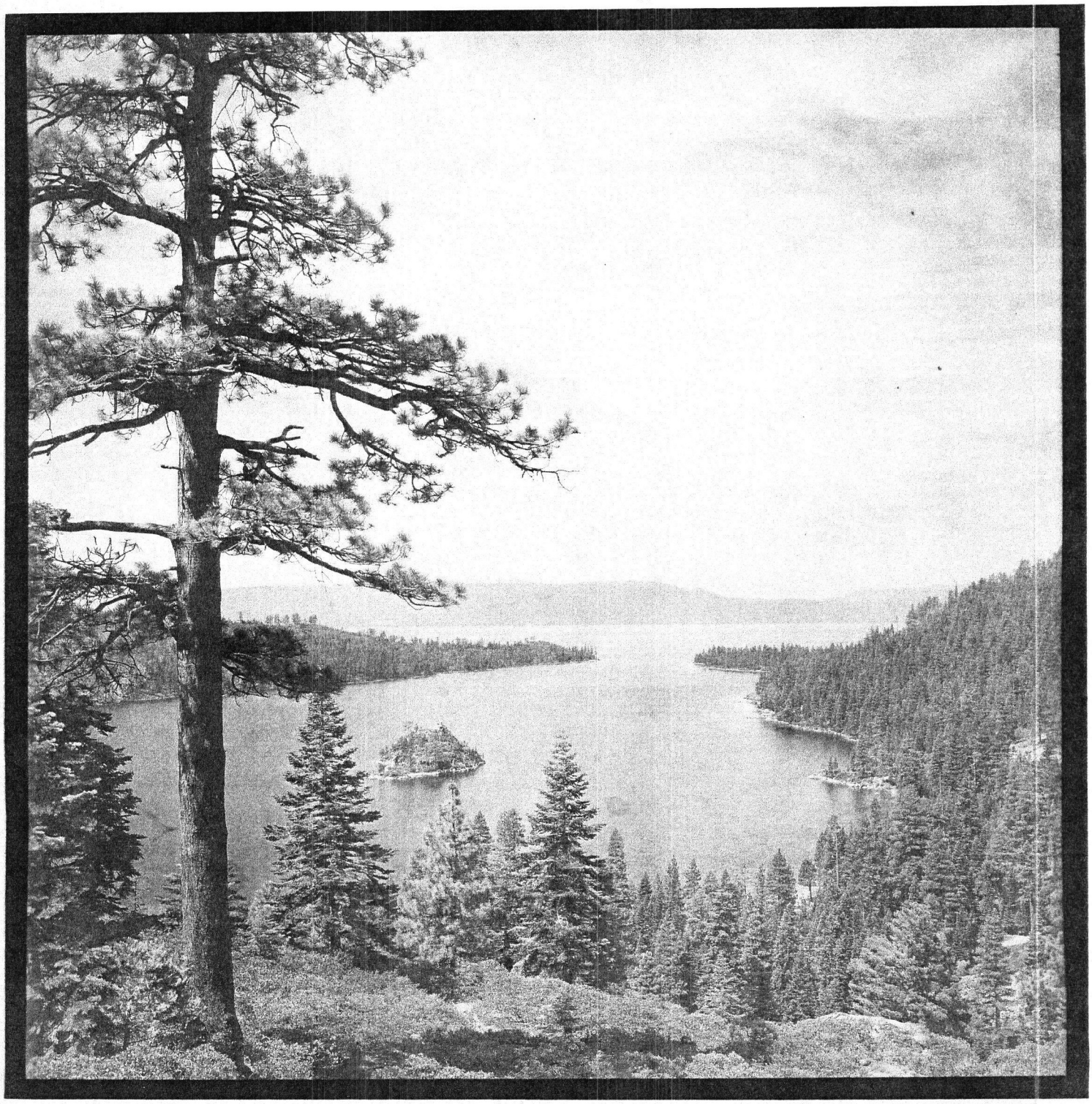
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

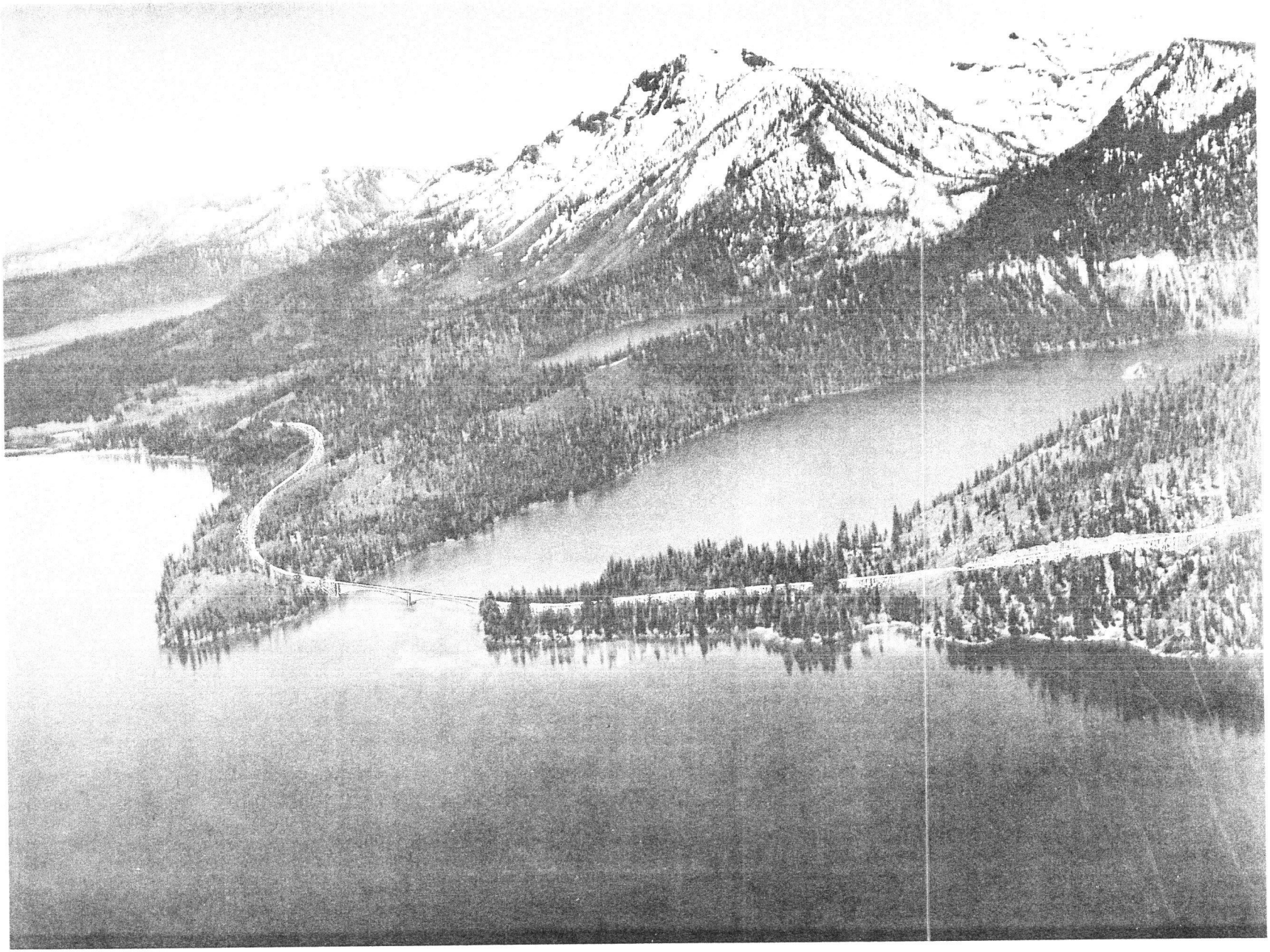
EMERALD BAY ROUTE STUDIES

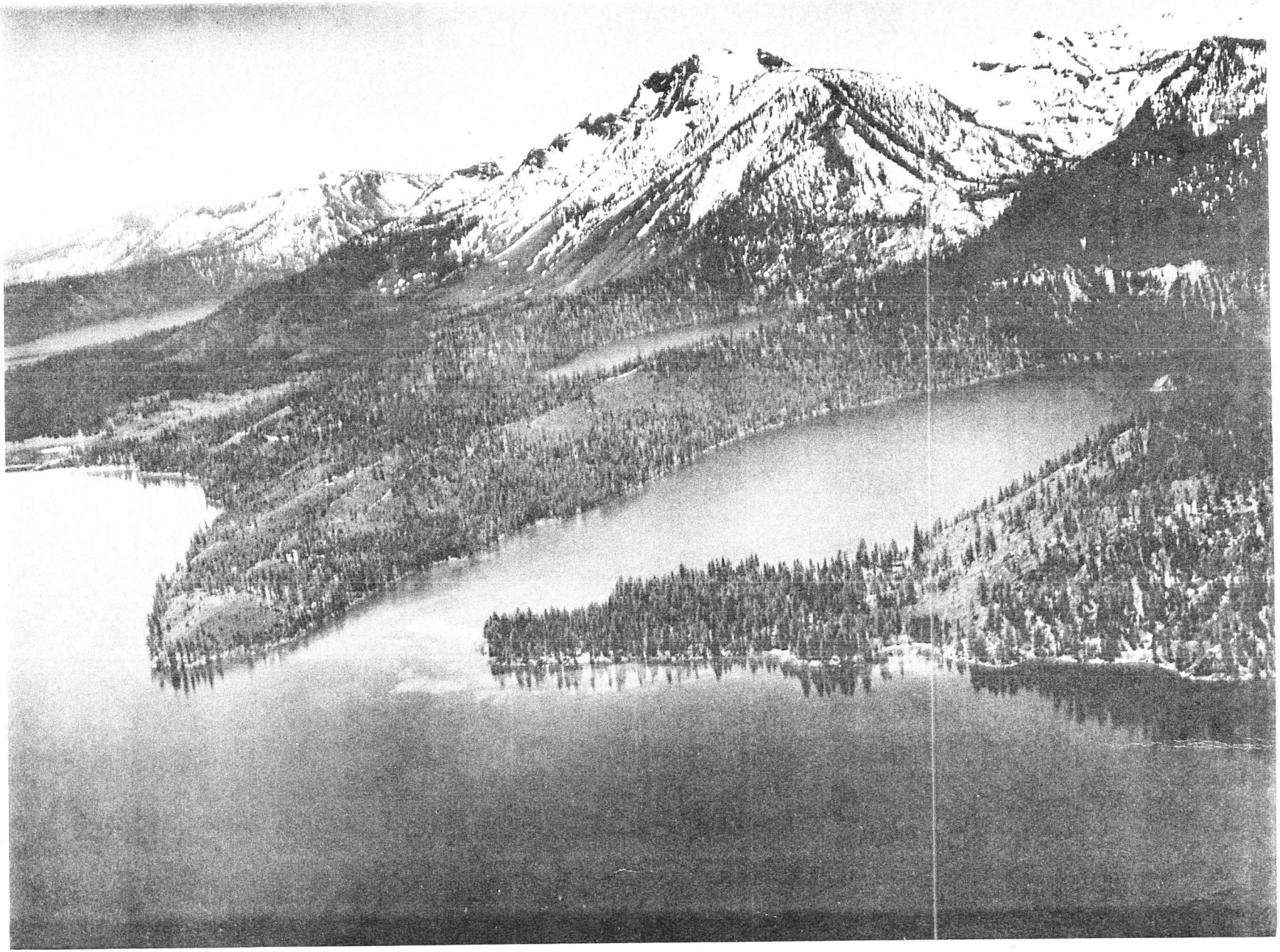


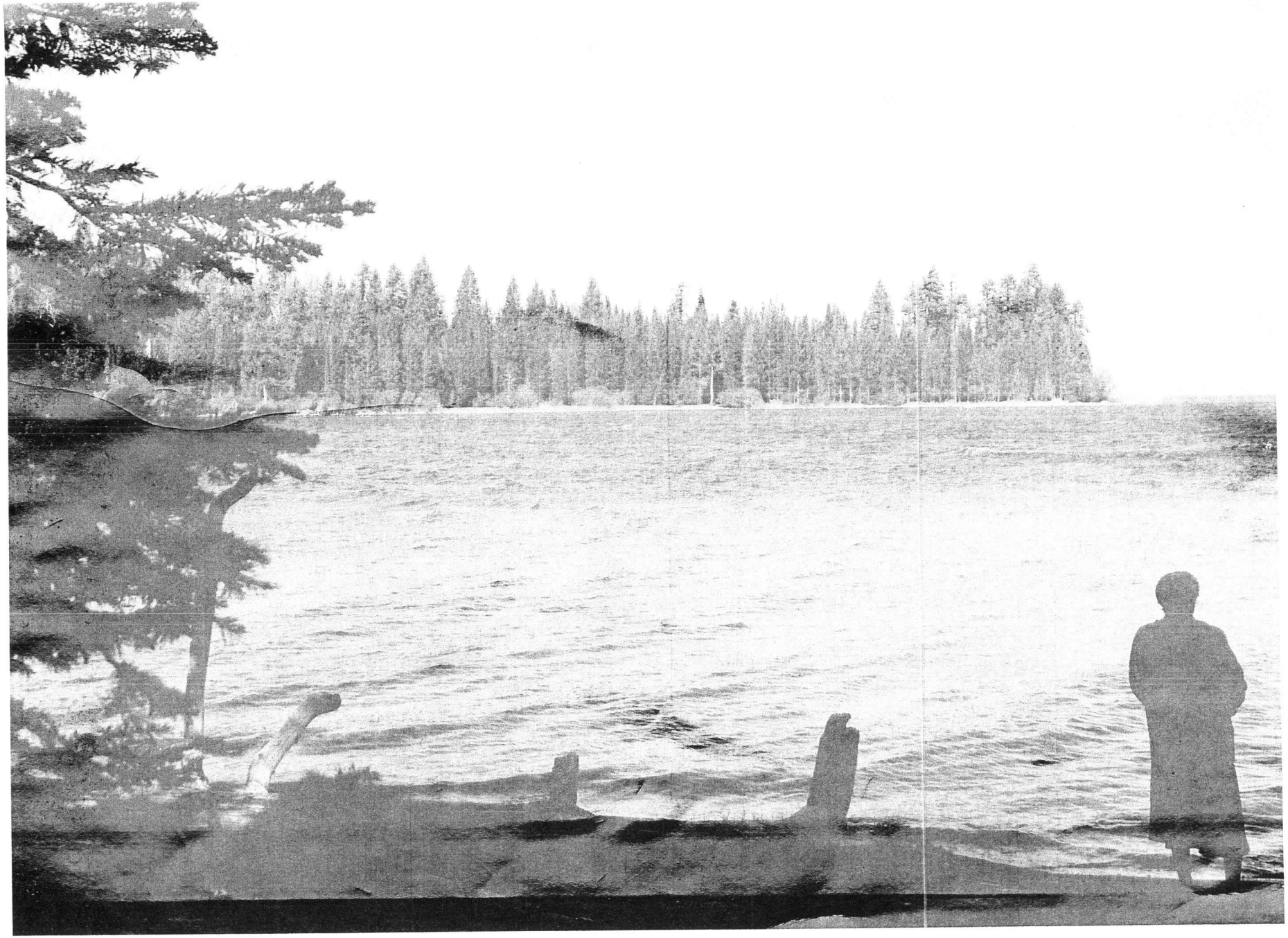
[Note: 5 loose images accompany report]

Note: 5 loose images accompany this report









NATURAL HERITAGE SECTION

November 14, 1960

Mr. Robert B. Bradford, Chairman, and Members of the California Highway Commission

and

Mr. Will Rogers, Jr., Chairman, and Members of the California State Park Commission

The following report covers further route studies toward the development of an all-year highway along the west side of Lake Tahoe in the vicinity of Emerald Bay. This portion of State highway is Road III-ED-38-B,C.

In keeping with the intent of the joint resolution adopted by the California Highway Commission and the California State Park Commission on March 19, 1959, these studies have been conducted with close liaison with representatives of the Department of Natural Resources, Division of Beaches and Parks. Toward this end, intensive studies have been made of the high and low routes around Emerald Bay and all possibilities that can be foreseen at this time have been covered.

Action on the highway location at Emerald Bay is being deferred by the Division of Highways pending further meetings between the California State Park Commission and the California Highway Commission.

J. C. WOMACK
State Highway Engineer

State of California

Department of Public Works

Division of Highways

EMERALD BAY ROUTE STUDIES

STATE LEGISLATIVE ROUTE 38

November 1960

Robert B. Bradford
Director of Public Works

J. C. Womack
State Highway Engineer

FOREWORD

Route 38, along the west side of Lake Tahoe, traverses an area of magnificent natural beauty and grandeur. The present highway was constructed between 1920 and 1925 along the precipitous slopes above the westerly shores of Emerald Bay. Closure of this road is necessary each winter with the advent of heavy snowfall, as the sheer slopes and extreme exposure lead to snow avalanches and rock slides.

Population growth in this area together with greater utilization of the Lake Tahoe area for recreational purposes, both in winter and in summer, now requires planning for an all-year highway. Only two general highway locations are feasible. One is along the shoreline of Lake Tahoe with a bridge crossing of Emerald Bay; the other at higher elevation, in the general location of the present road which skirts the westerly shores of Emerald Bay. This is an engineering report on the feasibility of these two routes for all weather service.

Valuable assistance has been rendered through the cooperation of personnel of the State Division of Beaches and Parks, Dr. Parker Trask of the University of California, and Dr. Arthur B. Cleaves of Washington University, St. Louis, Missouri.

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I. GENERAL

There is an increasing need for construction of an all-year route on the west side of Lake Tahoe. As U. S. Highways 40 and 50 are improved to freeway standards to meet the needs of expanding population and traffic, there will be an increased demand to keep Route 38 open all year along the west shore of Lake Tahoe.

For more than 25 years U. S. 40, the Donner Summit Route, and U. S. 50, the Echo Summit Route, have been kept open for winter travel except during abnormal storm periods. However, it has never been practical to keep Route 38 (the north-south connection route in California) open in the vicinity of Emerald Bay even in the mildest winters.

During the periods of closure, travel between Mays "Y" at the south end of the Lake to Tahoe City must be by way of the Nevada side, a distance of 44 miles instead of the 28 miles via Route 38 in California. The extremely precipitous slopes above the highway in the vicinity of Emerald Bay, with attendant snow avalanche conditions, have precluded winter clearance of that section. Snow removal is regularly accomplished to within two miles of south of Emerald Bay and to the Bliss State Park entrance north of the Bay.

During the last 15 years, except for the 2 years when the slides at Emerald Bay prevented opening the road at all, the road has been blocked to traffic an average of 5-1/2 months per year. It is usually closed by the first major snowfall in late November or early December and remains closed until late April or early May.

The potential danger of rocks released from the steep slopes above the highway by freezing and thawing action or by rainfall has made it unsafe to open the highway to public travel earlier in the spring. Snow removal operations are most hazardous owing to possibilities of snow slides and one State employee suffered a fatality during such operations on April 7, 1935. For these reasons, clearing activity is usually deferred until only a relatively short section of deep snow remains.

The difficult snow removal problem on the present road is not confined to the slide area immediately north of Bay View Rest. The entire north side of the Bay from near Eagle Falls Creek to the entrance of the Emerald Bay Resort is also a hazardous area. Past history of snow avalanches and large boulders found on the roadway in spring snow clearance make all-year safe travel questionable.

On November 15, 1955, Route 38 was closed by snow. Sometime during the latter part of December and subsequently, landslides occurred at a location just north of Bay View Rest. This was a major slide and required costly removal of some 200,000 cubic yards of material. It was most difficult and dangerous work and it was not possible to open the route until November 3, 1956. The route was again closed by snow

and a minor slide on December 4, 1956, and remained closed until March 30, 1957.

II. PREVIOUS STUDIES

General studies were instituted by the Division of Highways in 1956 toward the development of an all-year highway in this area. These earlier studies indicated the possibility of an all-year route at a lower elevation following the shoreline of Lake Tahoe with a bridge across the mouth of Emerald Bay. Engineering studies made at that time were insufficient for conclusions as to the possibility of construction of an all-year route along the existing road location owing to the engineering problems involved with the rugged terrain.

Any feasible highway routing in this area will, of necessity, involve State-owned lands under the jurisdiction of the California Department of Natural Resources, Division of Beaches and Parks.

A meeting between the California Highway Commission and the State Park Commission was held March 19, 1959, in the Public Works Building, Sacramento, for the purpose of discussing the problems involved in constructing an all-year highway in the Emerald Bay area.

At this meeting a joint resolution was passed by the two Commissions which read as follows: "For the two Commission Chairmen to agree to hold ourselves subject to another meeting, to get together and solve this problem

when more information is developed; meanwhile to continue our own technical staffs working along in a separate or joint way, to bring forth more information".

III. ROUTE STUDIES

Route studies have been made by the Division of Highways in order to fully explore all alternatives with particular emphasis on the effect of interference with the fullest development of the Emerald Bay and D. L. Bliss State Parks. Accordingly, these studies have been made with full consideration of types of design and construction that would reduce and minimize the effect of construction on the usability of park areas and that would preserve to the maximum the great natural beauty of the area.

In conformance with the intent of the joint resolution of the State Parks Commission and the California Highway Commission, close liaison has been maintained by the representatives of the State Division of Beaches and Parks and the State Division of Highways. In August of 1960 two joint field reviews were made by representatives of the two divisions toward mutual understandings of the problems involved. Through correspondence and exchange of information, much assistance has been rendered to the staff of the Division of Highways.

Further field topographic surveys and geological studies have been made by the Division of Highways. The

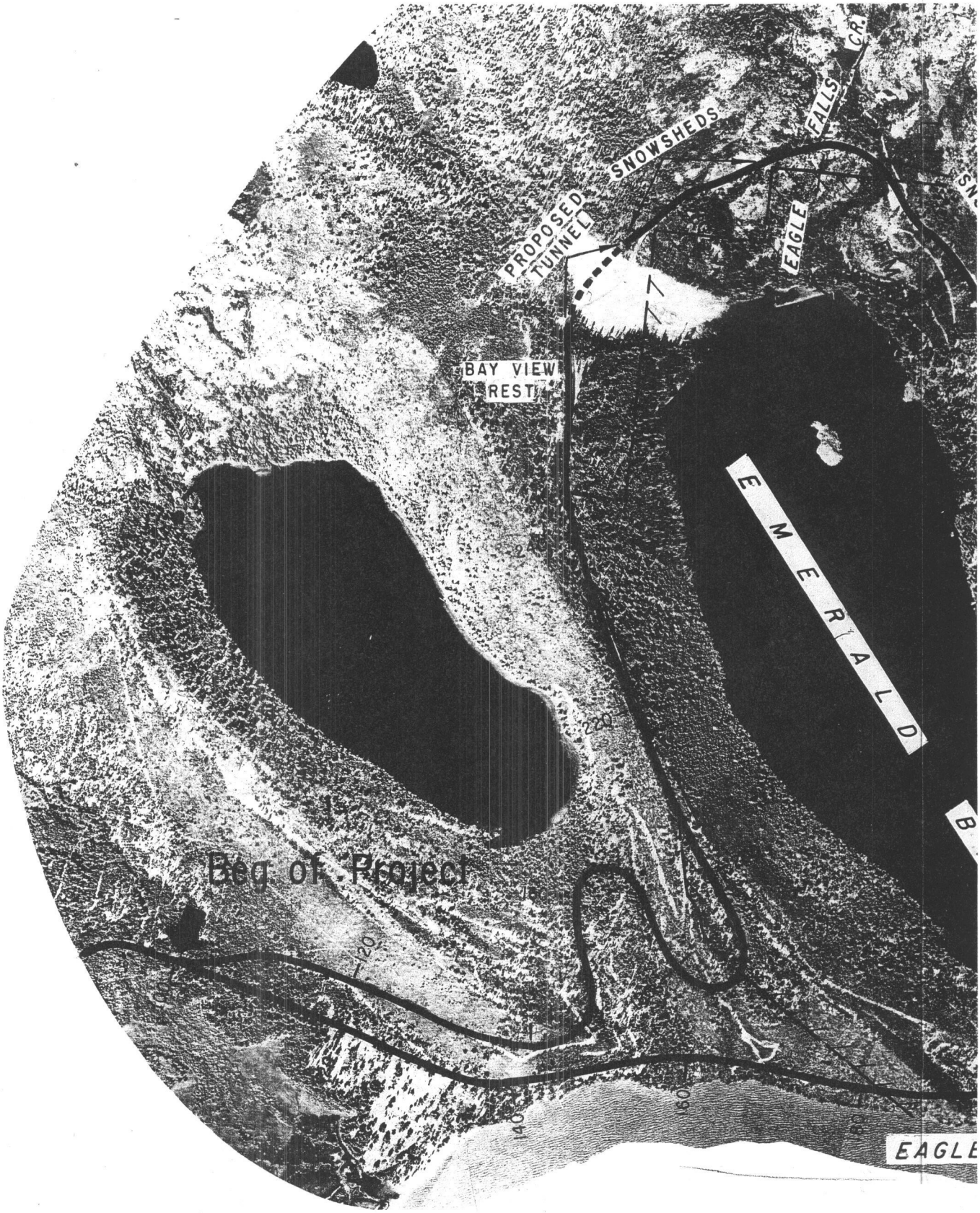
earlier studies by Dr. Arthur Cleaves, the geological consultant for the Division of Highways, have been augmented by information and opinions from Dr. Parker D. Trask. His helpful suggestions based on experiences in Switzerland, Chile, and the State of Washington have been of assistance in the development of a plan for snow shed type of protection against earth and snow avalanches.

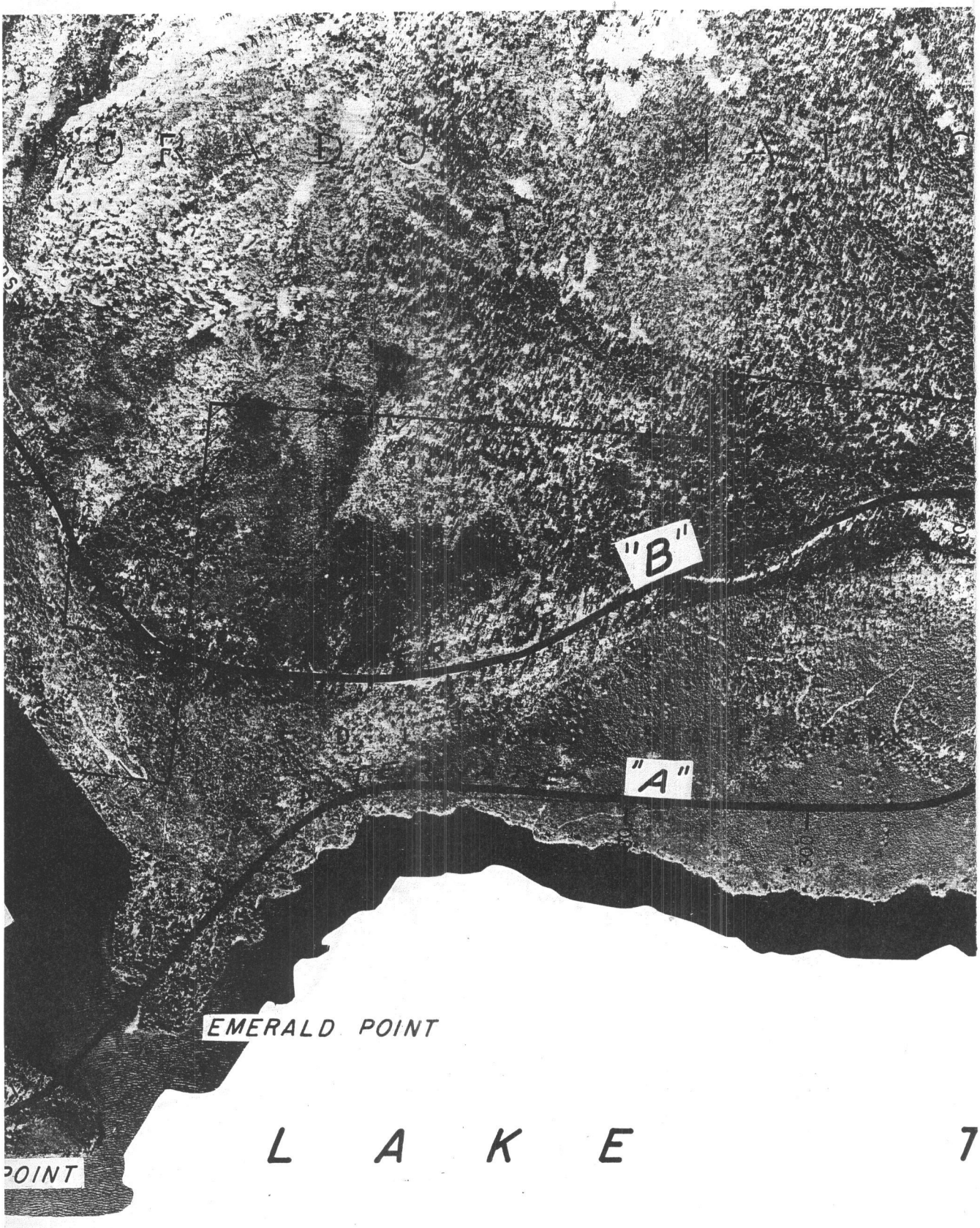
The studies instituted by the Division of Highways cover two possible routings. The first routing is a low elevation line following the shoreline of Lake Tahoe and bridging the mouth of Emerald Bay. This low line is indicated as Alternate A on Plate A. The second routing is a line at higher elevation which would skirt the west limits of Emerald Bay by following the approximate location of the existing highway. The high line is indicated on Plate A as Alternate B.

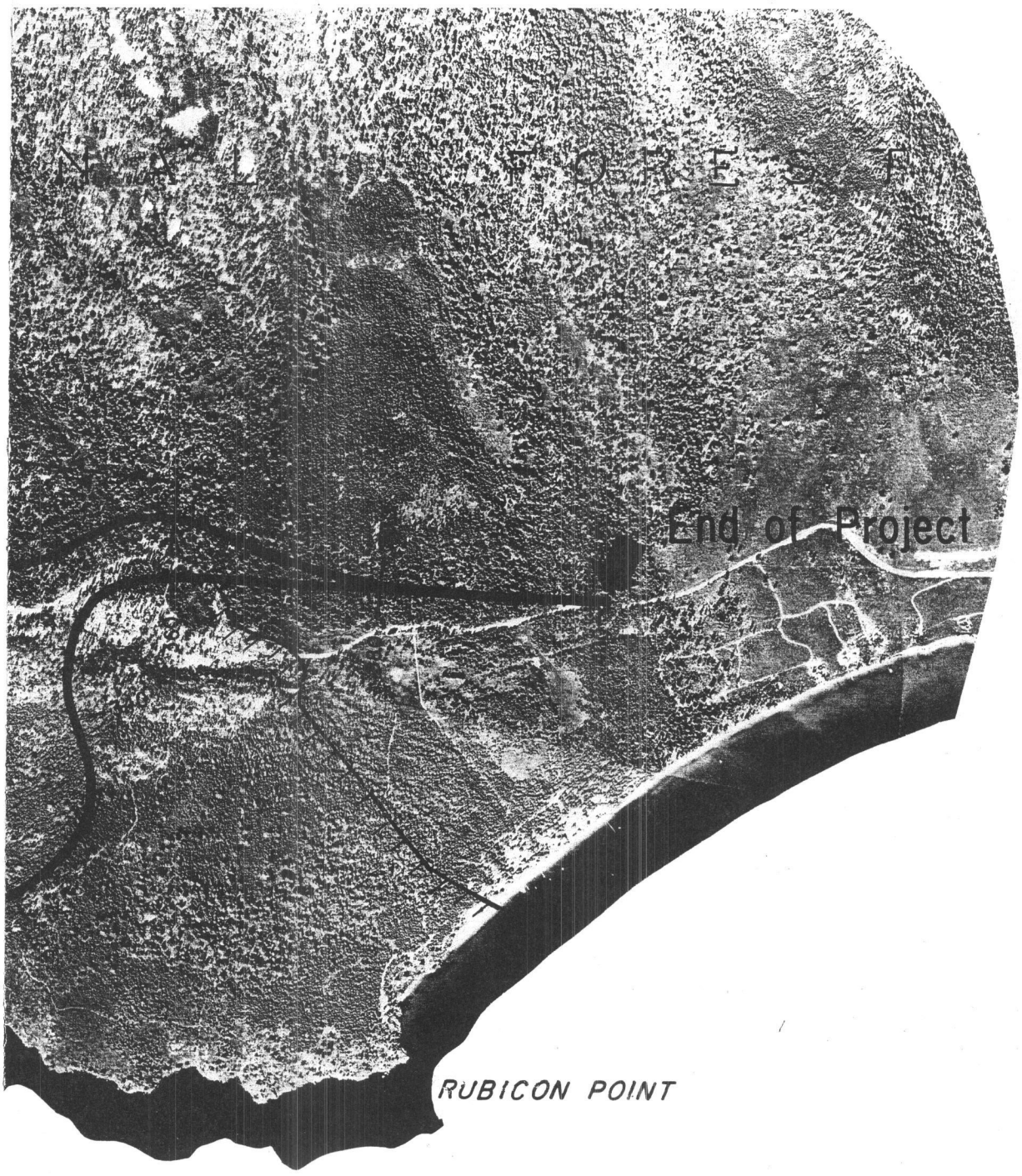
The construction costs used in the various plans for Alternate A and Alternate B are based on the most recent survey data and adjusted to present contract prices prevailing in the general area.

IV. ALTERNATE A - LOW LINE

The plans studied on Alternate A for the purpose of exploring two possible methods of crossing Emerald Bay and the flat area northerly of the proposed bridge in order to minimize land taken for highway purposes. Either plan will provide an all weather highway. Earlier general studies involved a bridge structure across Emerald Bay with a resulting high embankment on the north shore which would be obviated by Plans A-1 and A-2 as detailed in the following discussions. Both alternates follow the alignment as shown on Plate A as Alternate A.


PROPOSED TUNNEL
SNOWSHEDS
FALLS CR.
EAGLE
BAY VIEW REST
EMERALD
Beg of Project
220
120
160
EAGLE


"B"
"A"
EMERALD POINT
POINT
L A K E



- A H O E

PLATE A

III-ED-38-B, C

Scale 1" = 1500'

Oct 1960

Plan A-1 - Length 5.72 Miles

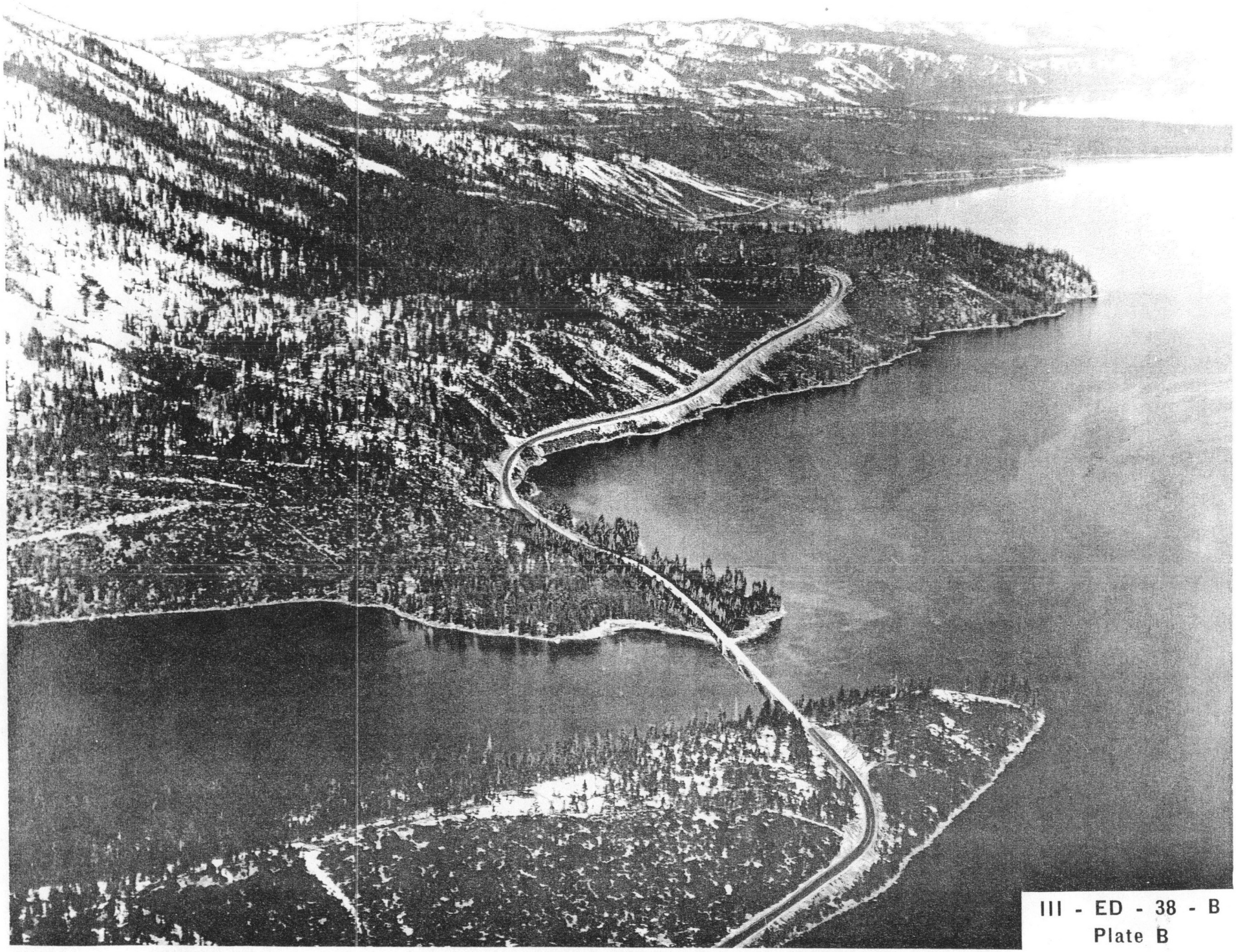
Plan A-1 is a modification of a previously considered grade line which proposed a fill of from 35 to 40 feet in height across the flat area north of the Bay. Under Plan A-1 the proposed bridge would be constructed on a descending grade of 1.5% with a resultant lowering of this fill to less than 20 feet in height. Two underpass or overpass structures are also proposed northerly of the bridge to permit park traffic to cross the freeway. In order to reduce land use in the rough terrain northerly of the flat area, it is proposed to use bin walls wherever long sliver fills and attendant scarring of the landscape can be eliminated by this method. In addition, considerable daylighting of cut sections on the lake side is proposed in order to provide suitable parking and vista areas.

At the northerly end of Bliss State Park the alignment has been adjusted to provide initial channelization at the proposed revision of the main park road in this area.

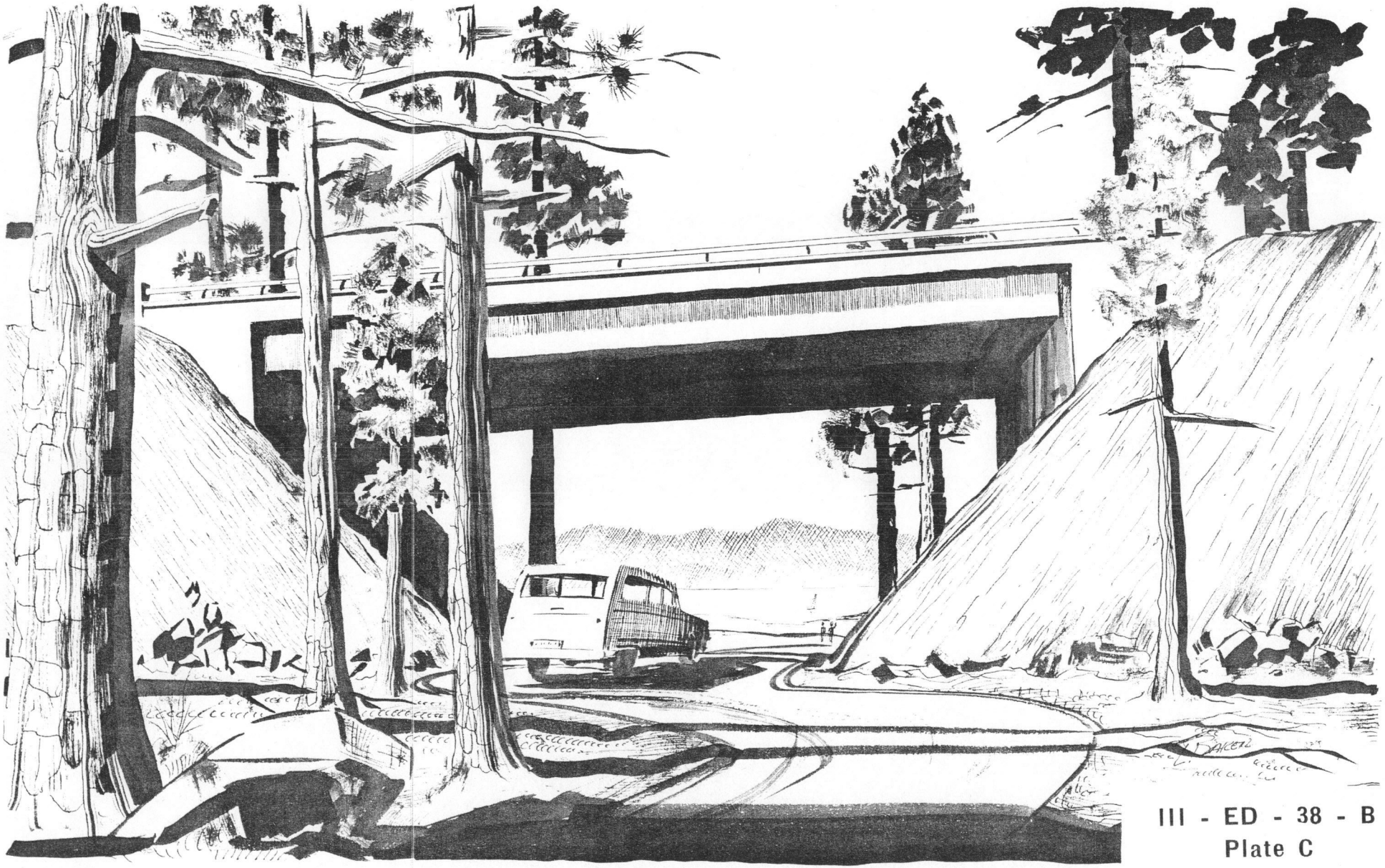
Estimated Cost of Plan A-1

Roadway	$3,460,000
Structures	1,640,000
Construction Total	$5,100,000
Right of Way	600,000
TOTAL	$5,700,000

Plate B presents a concept of this type of construction and Plate C presents a concept of the embankment north of the proposed Emerald Bay Bridge.



III - ED - 38 - B
Plate B



III - ED - 38 - B
Plate C

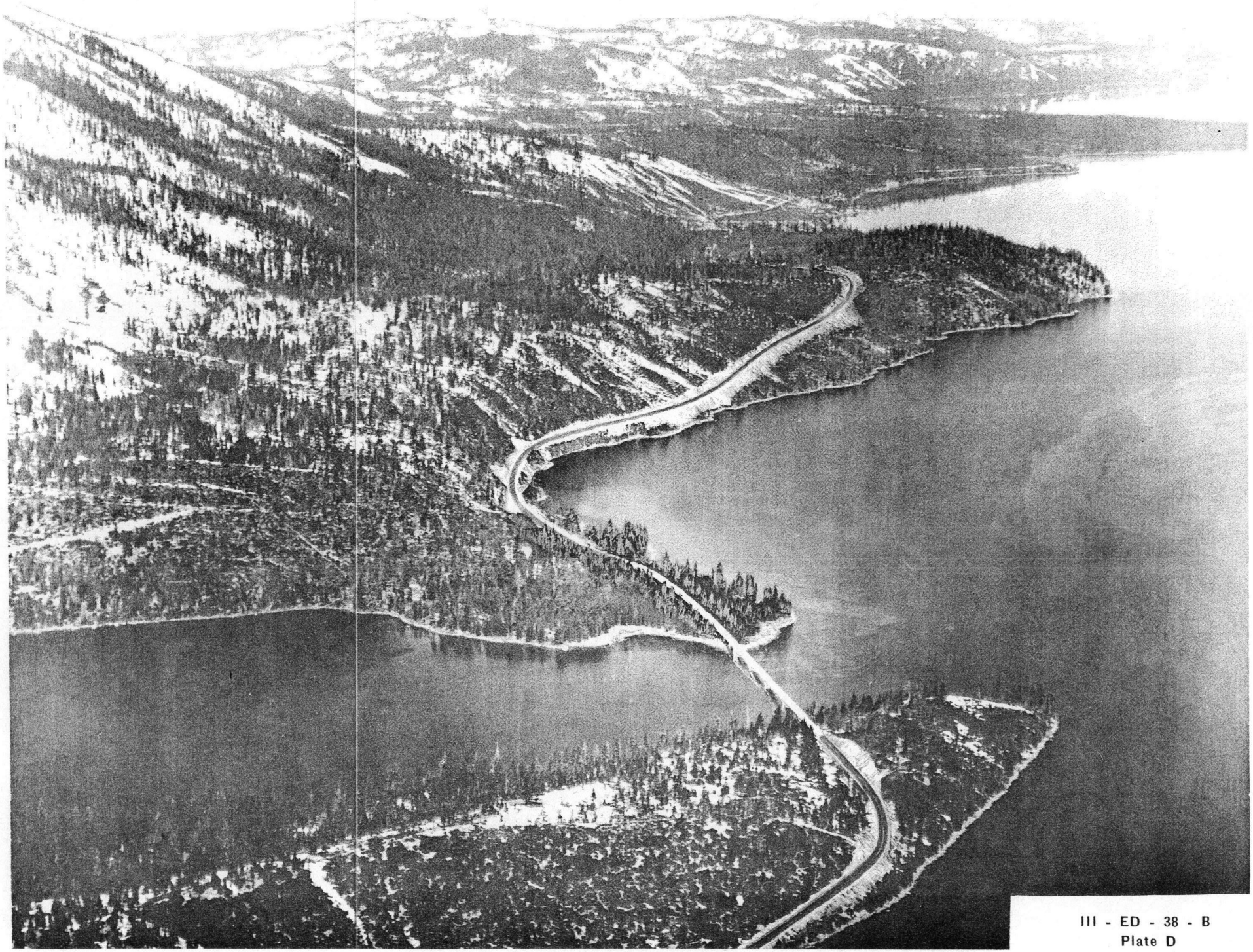
Plan A-2 - Length 5.72 Miles

Plan A-2 utilizes a level grade on the proposed Emerald Bay Bridge; however, in lieu of an embankment northerly of the bridge, a viaduct approximately 2,000 feet in length is proposed. This would provide full sight distance and free access under the viaduct.

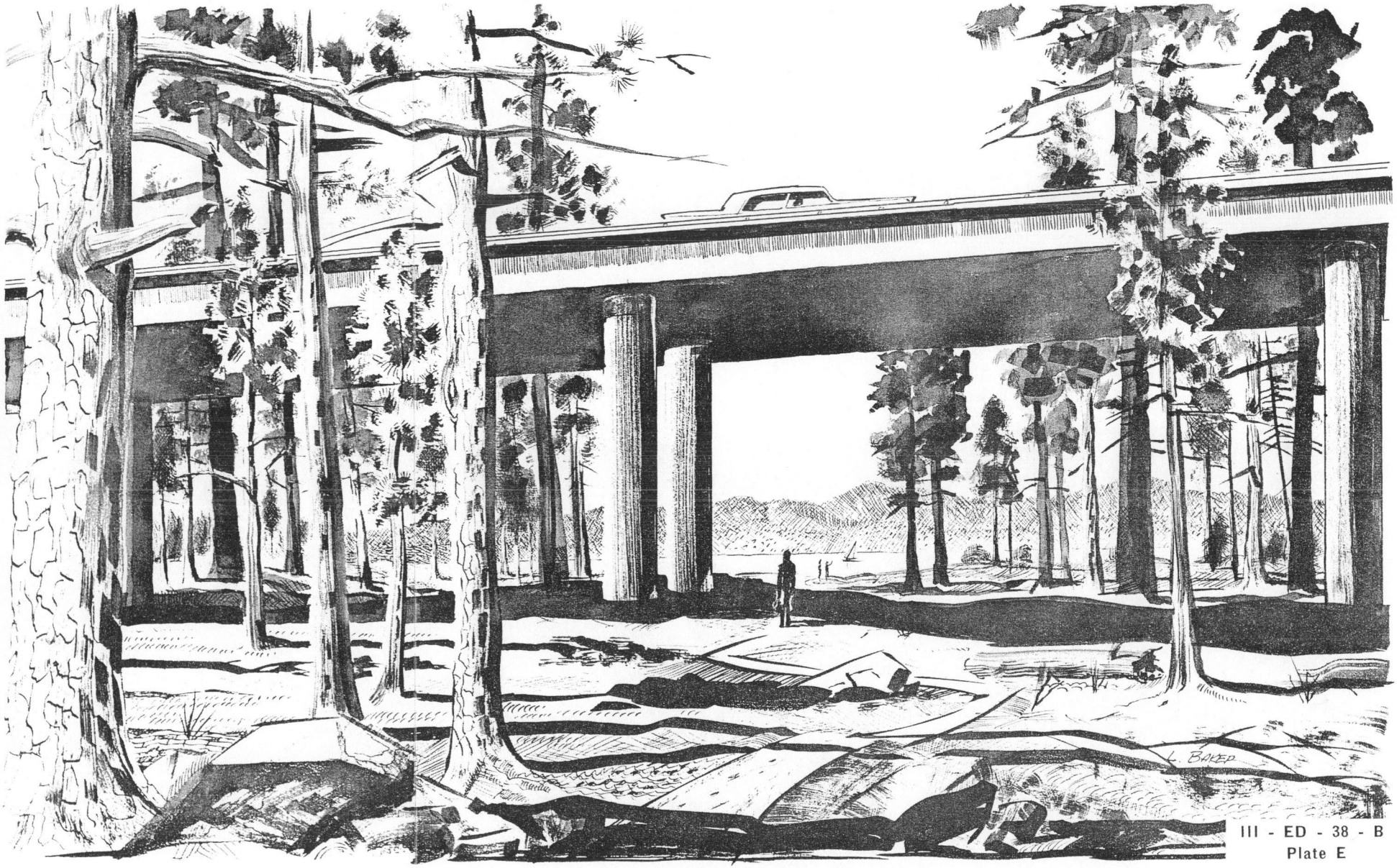
Plates D, E, and F are architectural sketches showing views of such a viaduct section approaching Emerald Bay Bridge. In all other respects Plan A-2 is similar to Plan A-1.

Estimated Cost of Plan A-2

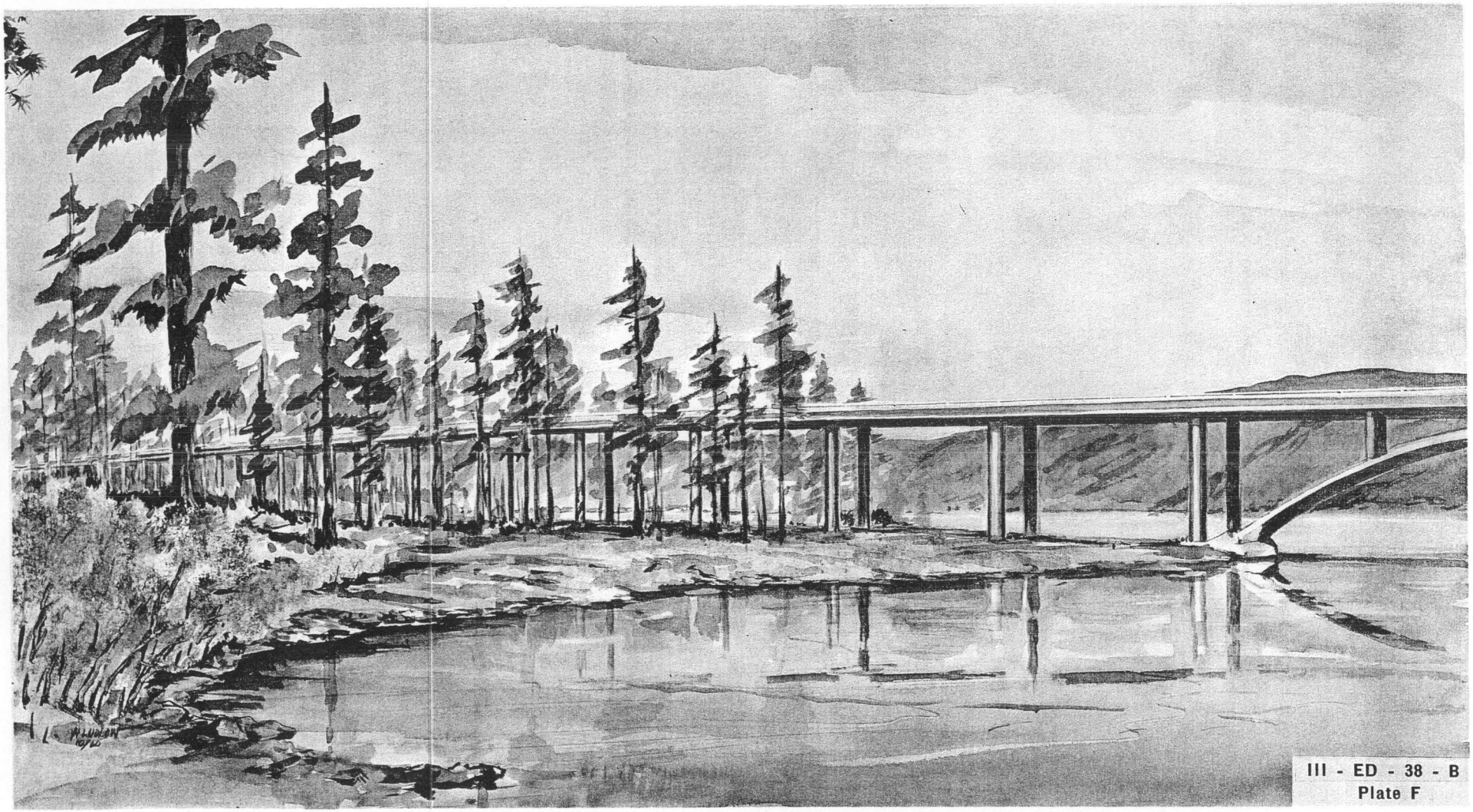
Roadway	$3,650,000
Structures	2,715,000
Construction Total	$6,365,000
Right of Way	600,000
TOTAL	$6,965,000



III - ED - 38 - B
Plate D



III - ED - 38 - B
Plate E



III - ED - 38 - B
Plate F

V. ALTERNATE B - HIGH LINE

Three general plans have been studied toward development of an all weather route on Alternate B. This is the high line along the general location of the existing highway. All of the Alternate B plans require a 1,300-foot tunnel under the large slide area northerly of Bay View Rest and a 1,500-foot snow shed from the north portal of the tunnel towards Eagle Falls Creek. All of the alternates also include 700 feet of snow shed immediately north of Eagle Falls Creek in an area where snow avalanches have been experienced in the past. Northerly of this 700-foot snow shed, three variations or plans have been considered as outlined in the pages that follow.

Plate A depicted the general routing of Alternate B while Plate G covers the area south of the proposed tunnel near Emerald Bay.



III - ED - 38 - B
Plate G

Plan B-1 - Length 7.75 Miles

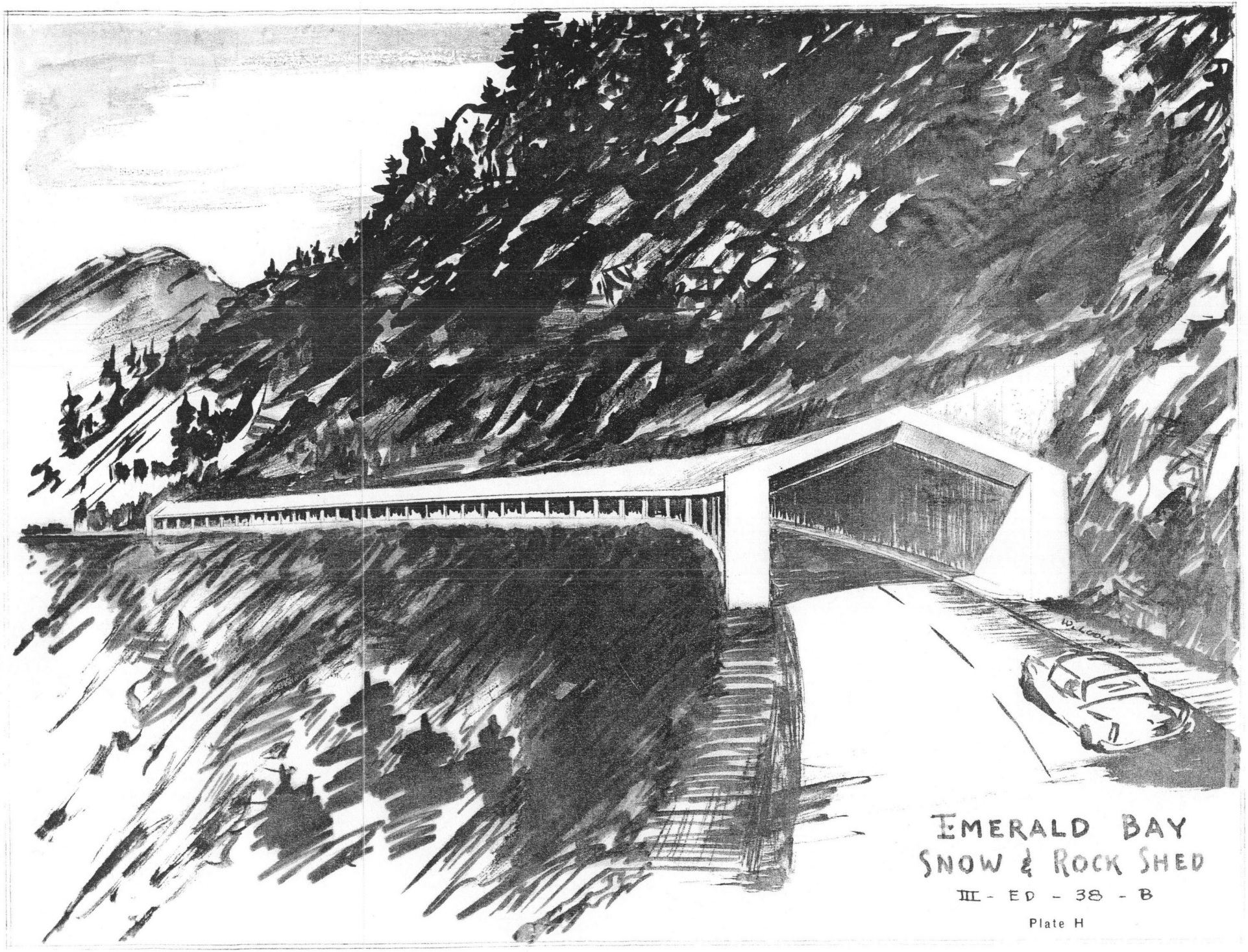
In addition to the 1,300 feet of tunnel under the massive slide area and 2,200 feet of snow shed, Plan B-1 contemplates extension of the snow sheds northerly a distance of 1900 feet through areas where snow avalanches and rock slides are experienced.

Plate H is a perspective sketch showing architectural treatment of proposed snow sheds.

It is believed that this plan could be successfully maintained as an all weather route; however, the construction and operation of such a road with the prevailing conditions of terrain and exposure would present certain elements of risk.

Estimated Cost of Plan B-1

Roadway	$2,480,000
Structures	$5,565,000
Construction Total	$8,045,000
Right of Way	580,000
TOTAL	$8,625,000



EMERALD BAY
SNOW & ROCK SHED
III - ED - 38 - B

Plate H

Plan B-2 - Length 7.75 Miles

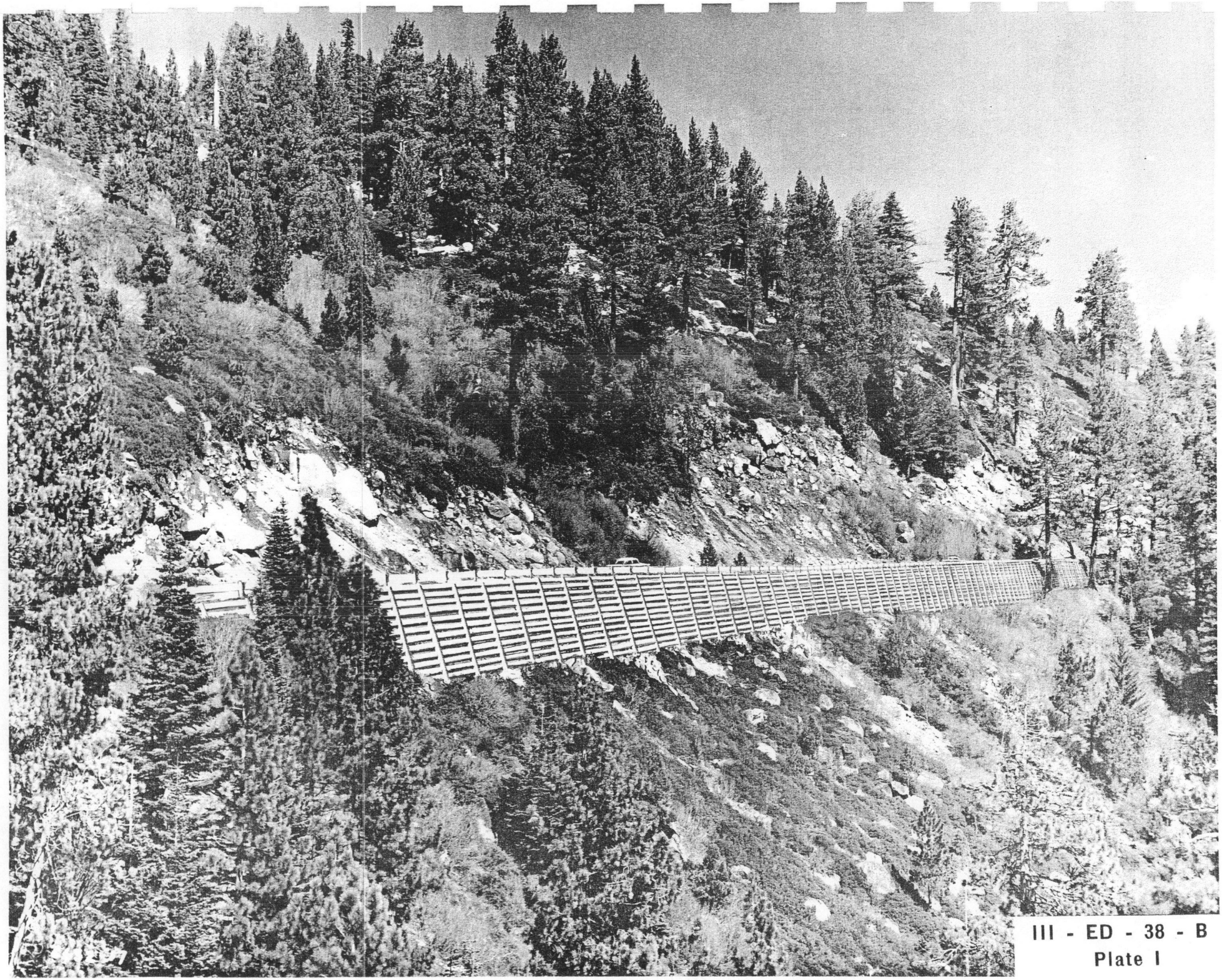
Plan B-2 involves a plan of locating the highway as far as practicable away from the existing cut slope in the northerly 1900 feet where Plan B-1 has utilized snow sheds. Bin walls 30 feet in height have been used in this plan. Although this plan avoids disturbing the existing unstable slope and provides a reservoir area offrom 15 to 40 feet for the storage of rocks, it is not considered to be an all weather highway since closure of the road by rock slides may still be anticipated.

This plan would still require the 1300-foot tunnel through the active slide area and the 2200 feet of snow shed immediately north of the tunnel.

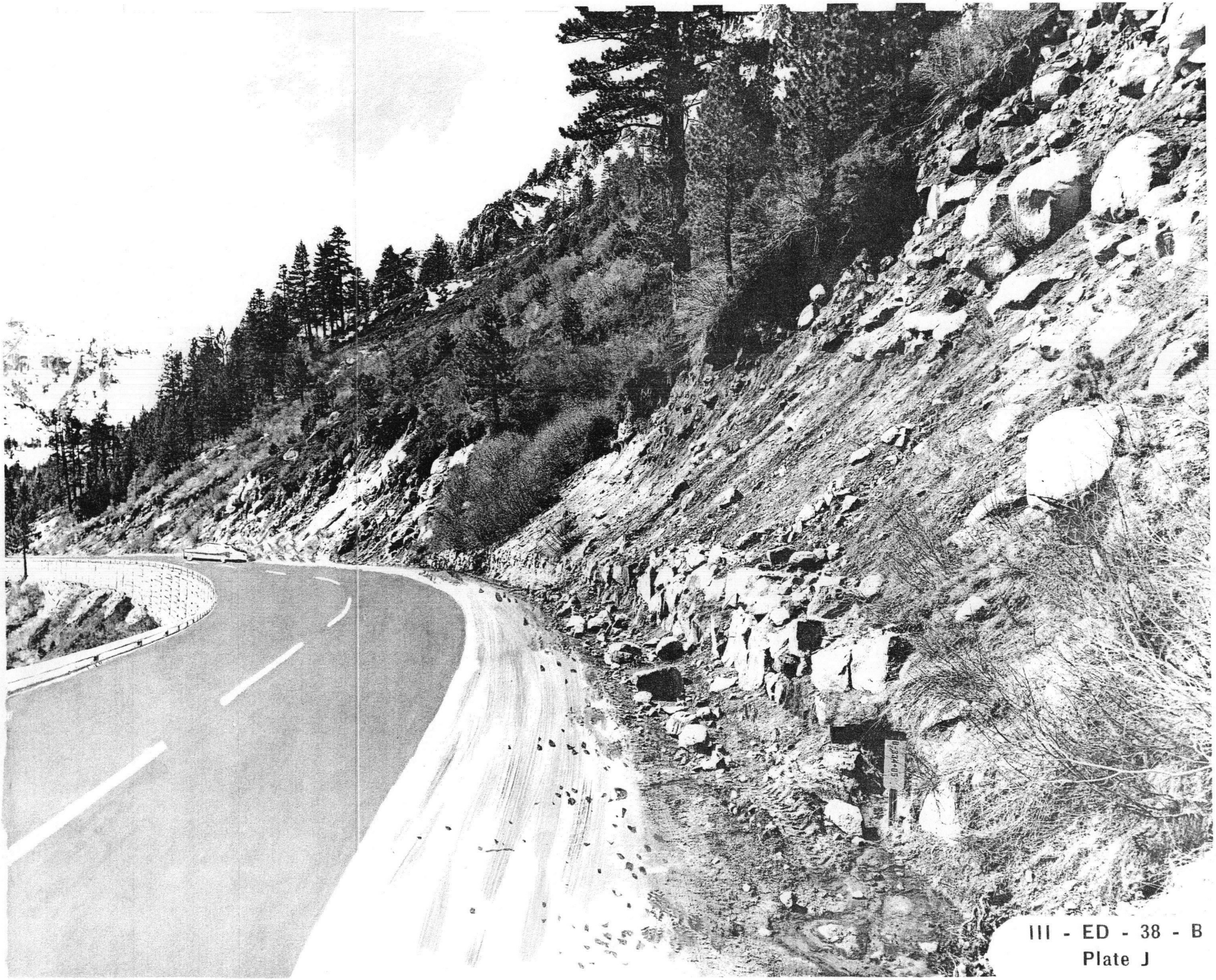
Plates I and J present typical examples of the bin wall and storage area type of construction.

Estimated Cost of Plan B-2

Roadway	$2,333,000
Structures	4,622,000
Construction Total	$6,955,000
Right of Way	530,000
TOTAL	$7,485,000



III - ED - 38 - B
Plate I



III - ED - 38 - B
Plate J

Plan B-3 - Length 7.75 Miles

Plan B-3 involves a plan of utilizing the existing rubble walls on the present road and developing a roadbed section with a 6-foot storage area for snow and slide storage in the northerly 1,900 feet previously mentioned in Plan B-2.

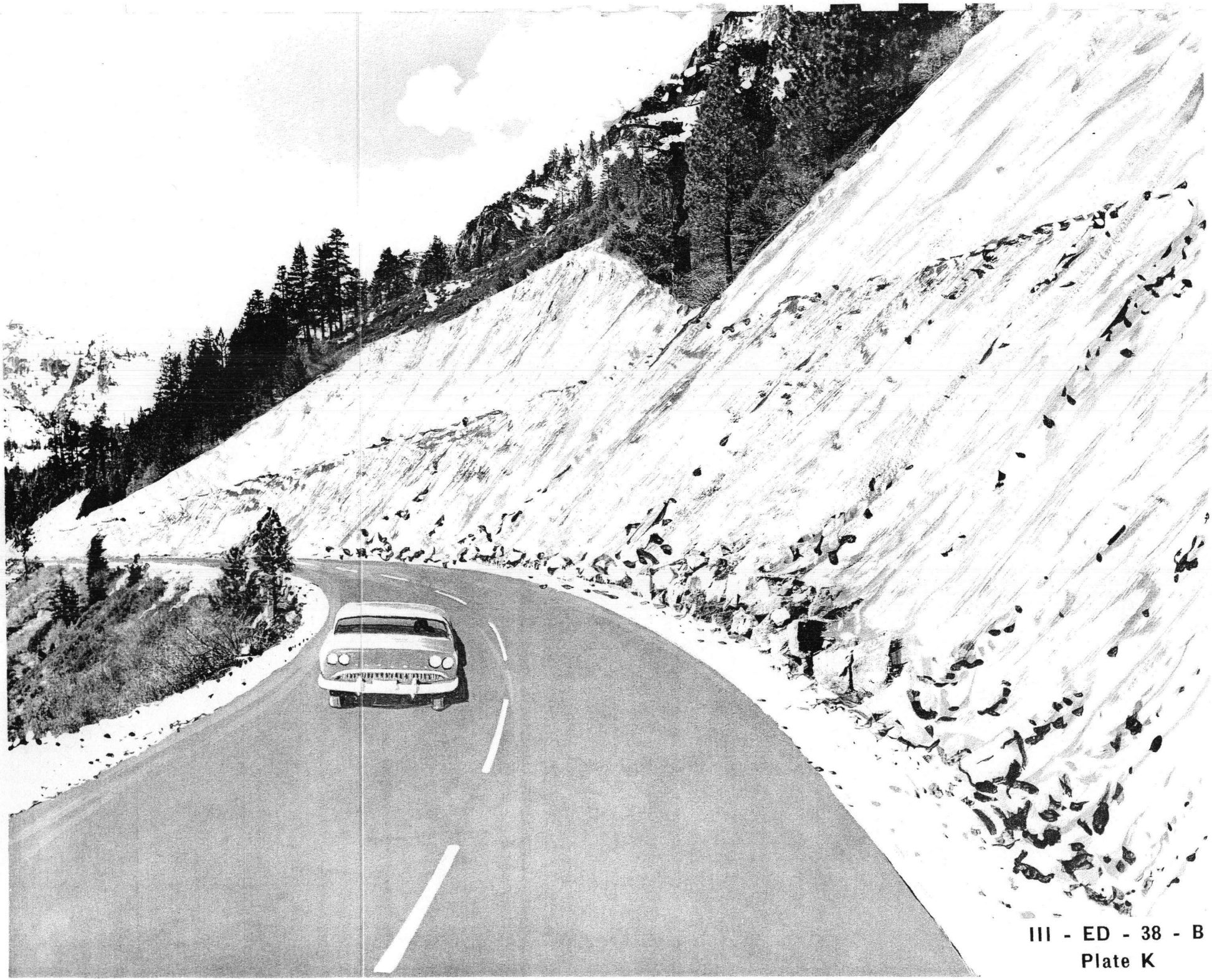
An alignment controlled by the present retaining walls would require considerable excavation and disturbance of the large boulder slopes above the existing road. Such excavation would require cut slopes of over 100 feet in height in the majority of the 1,900-foot length. In addition to the increased hazard from slides and rolling rocks, this plan would present substantial scars in the natural vegetation which would be similar in appearance to the existing slide area south of Eagle Falls Creek.

Plates K and L present an illustration of the type of construction considered under Plan B-3.

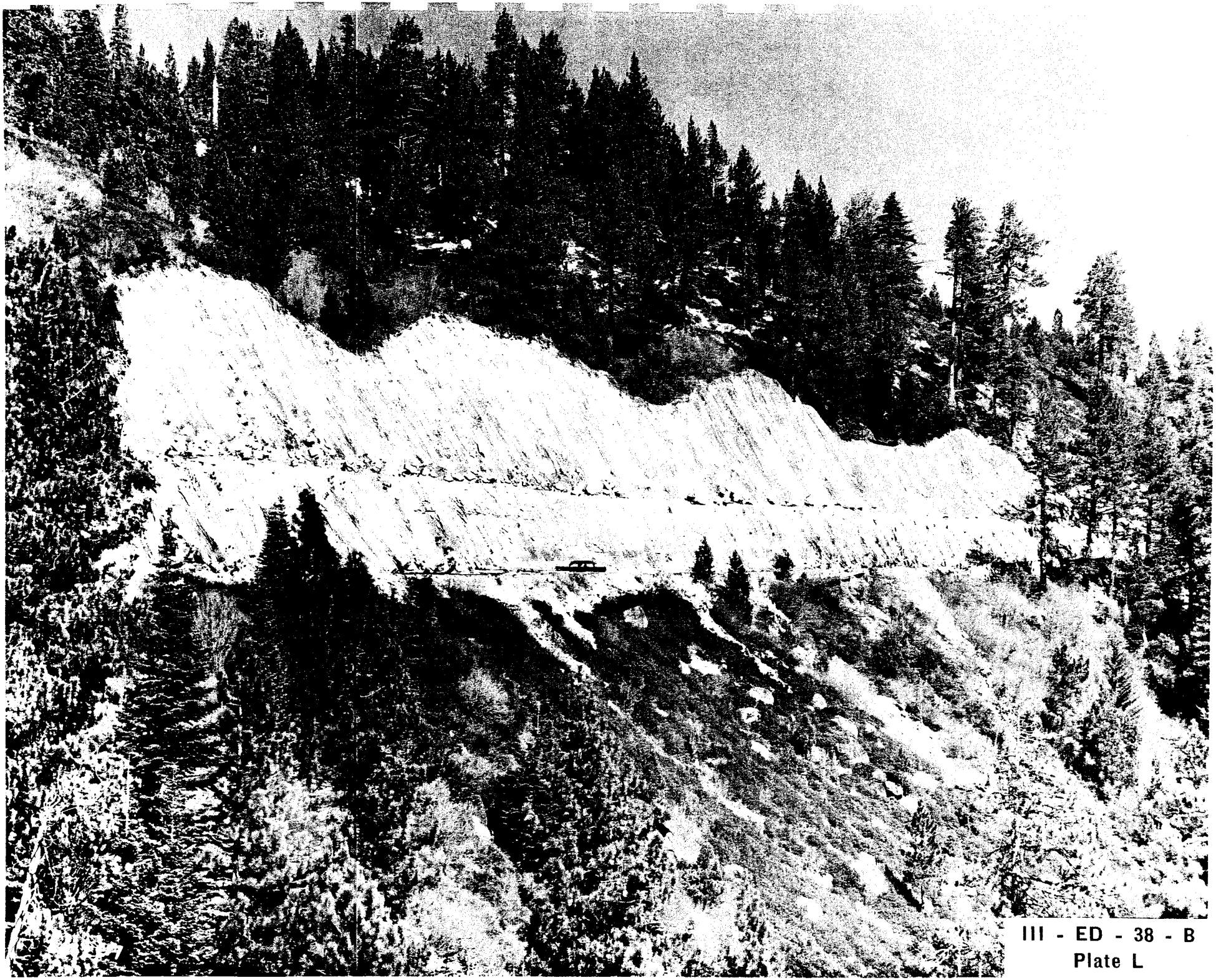
This plan would afford less protection from rock slide and snow avalanches than Plan B-2 and accordingly is not considered to be operable as an all weather highway.

Estimated Cost of Plan B-3

Roadway	$2,785,000
Structures	$3,950,000
Construction Total	$6,735,000
Right of Way	540,000
TOTAL	$7,275,000



III - ED - 38 - B
Plate K



III - ED - 38 - B
Plate L

VI. DISCUSSION

1. From this study it is concluded that an all weather route could be maintained along the westerly portion of Lake Tahoe either in the general location of Alternate A or in the general location of Alternate B.

2. Alternate A, which bridges Emerald Bay, is more direct, having a length of 5.72 miles as compared to 7.75 miles for Alternate B. Based on an estimated 1965 average daily traffic of 2,525, the shorter length of Alternate A could result in a substantial savings over a 20-year period of operation.

3. Owing to the more advantageous terrain, a highway constructed along the alignment of Alternate A could be expanded in the future, if necessary, to a four-lane road. It is not considered economically feasible to construct a roadbed width in excess of two lanes along the alignment of Alternate B.

4. The construction and right of way costs along Alternate A are estimated to be between $5,700,000 and $6,965,000 depending upon the exact design utilized. For comparison, the only feasible all-year highway plan developed along Plan B is estimated to cost $8,625,000.

5. Alternate A could be constructed with relatively easy gradients in an area where snow removal operations and annual maintenance cost would be minimized. Alternate B would require steeper gradients

through a higher location where drifting snow, snow avalanches, or landslides would always pose a risk to the expensive and extensive snowshed structures which would be required. Plate M depicts profiles of the proposed roadways of Alternates A and B.

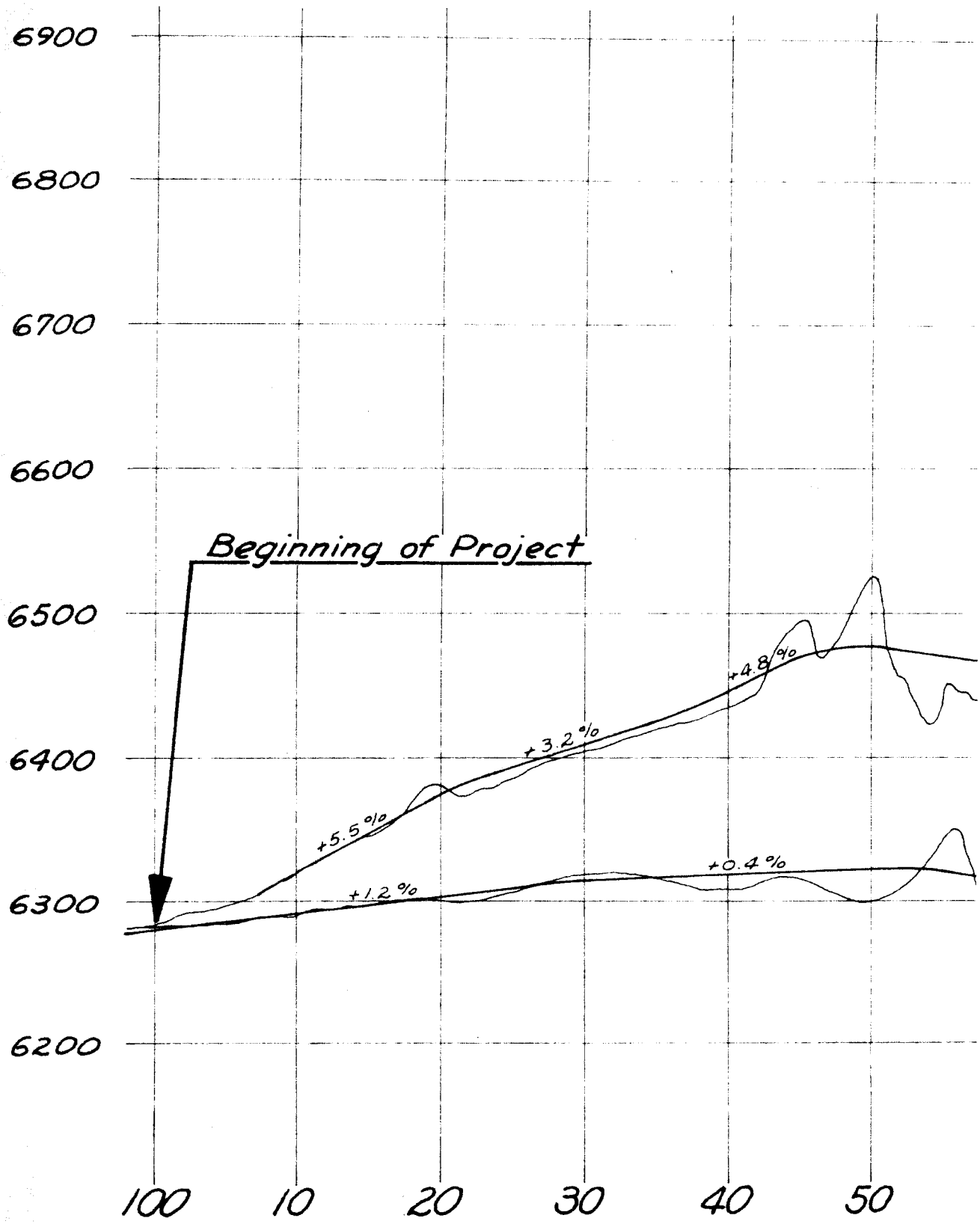
6. The easier terrain traversed by Alternate A would permit a highway location with only 16 curves, while the location along Alternate B would require a total of 34 curves. The minimum radius required for curvature in Alternate A would be approximately 900 feet as compared to the minimum of 500 feet required for Alternate B.

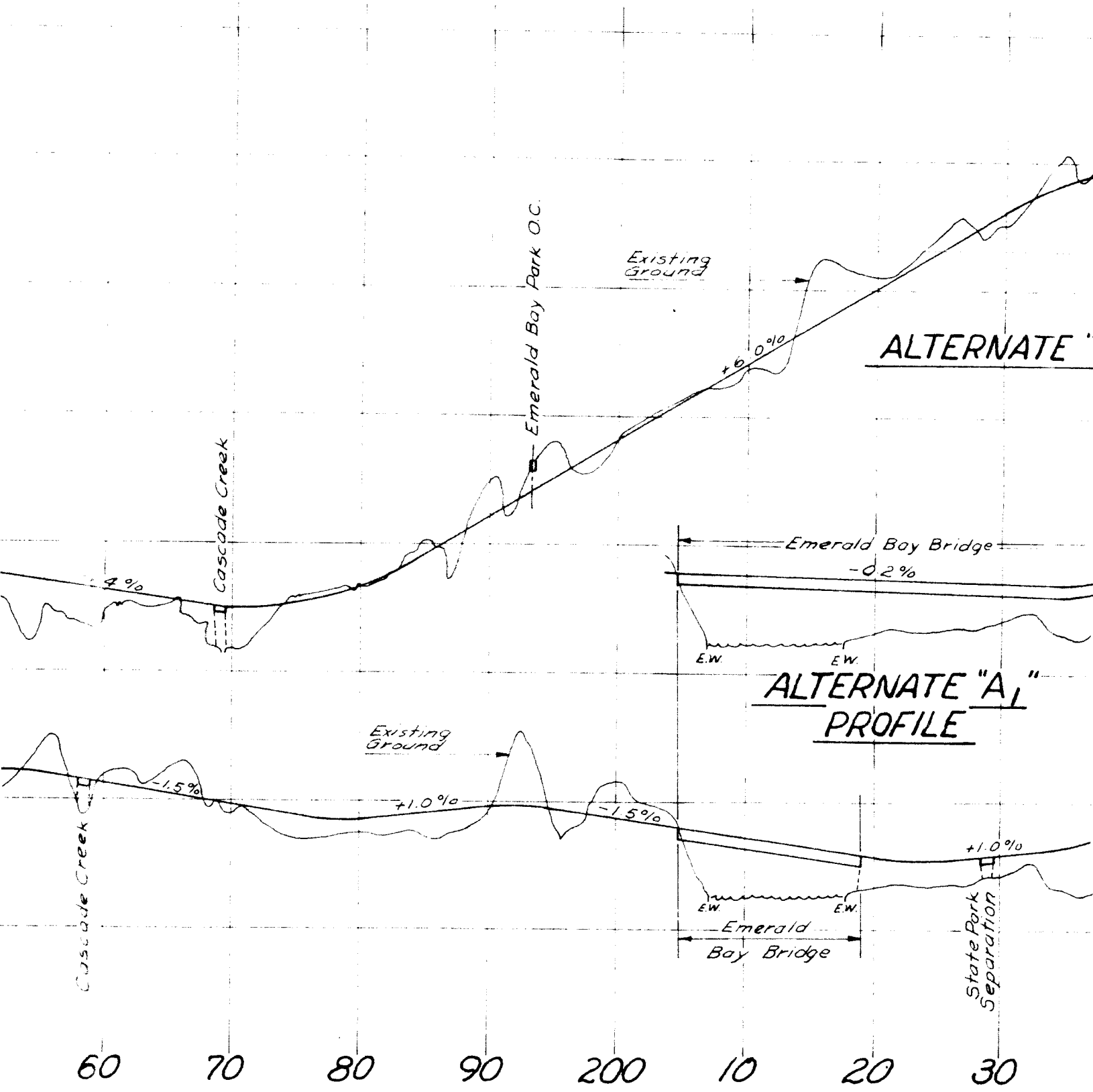
7. A two-lane roadbed is the maximum considered practical for the terrain along Alternate B. Such a width of roadbed does not provide ample opportunities for parking and sight-seeing if heavy through traffic is carried on the same roadbed. The construction of Alternate A will provide an additional roadbed for through traffic, thus making it possible for the existing road along Alternate B to be operated and maintained by the appropriate authorities as a summer recreation road providing access to campgrounds and vista points overlooking Emerald Bay. Since the existing road along Alternate B and the proposed road along Alternate A would both be available in the summer months, traffic would be somewhat divided between the roadways and the necessity for four-lane construction might be obviated for many years.

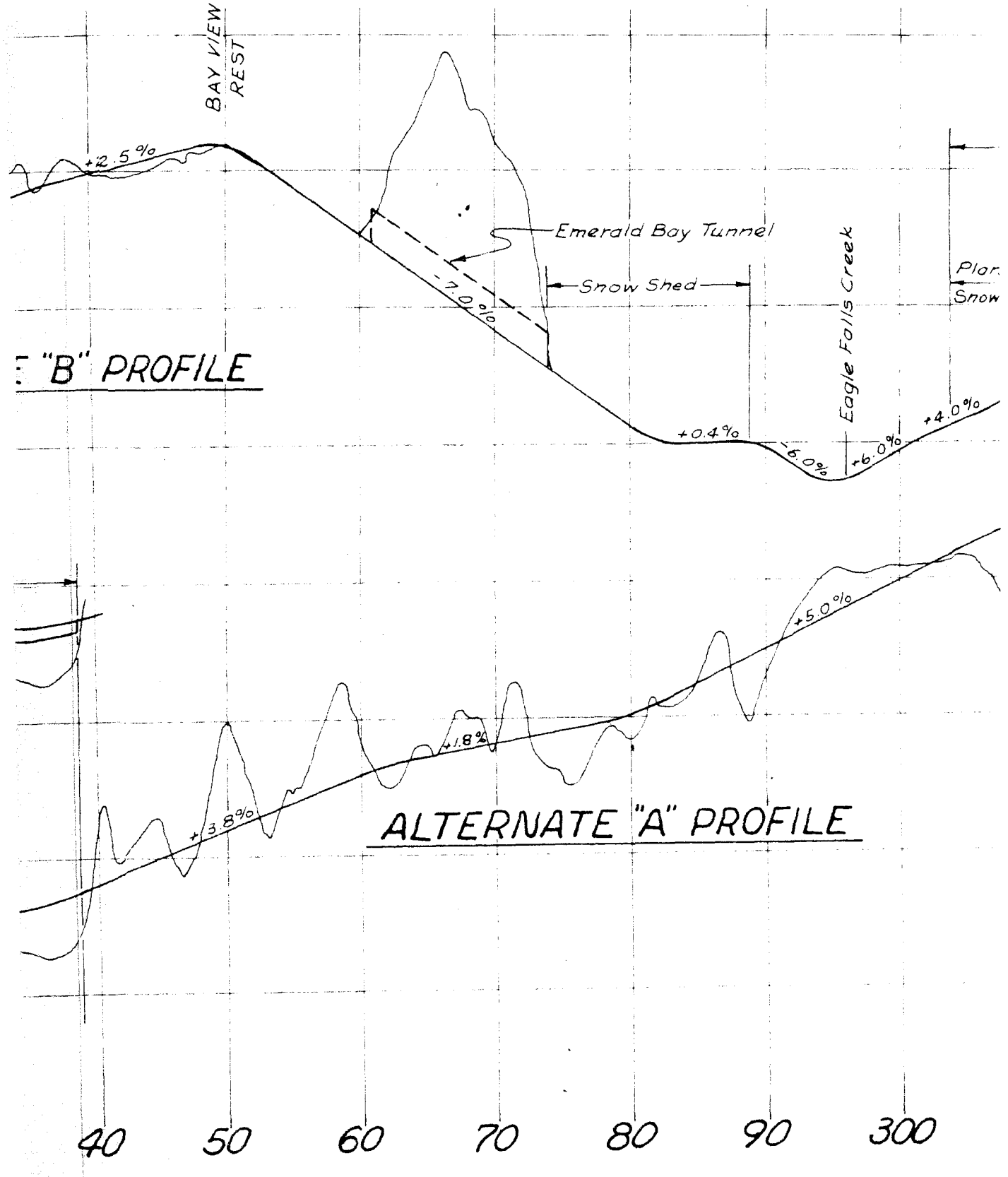
VII. COMPARATIVE DATA

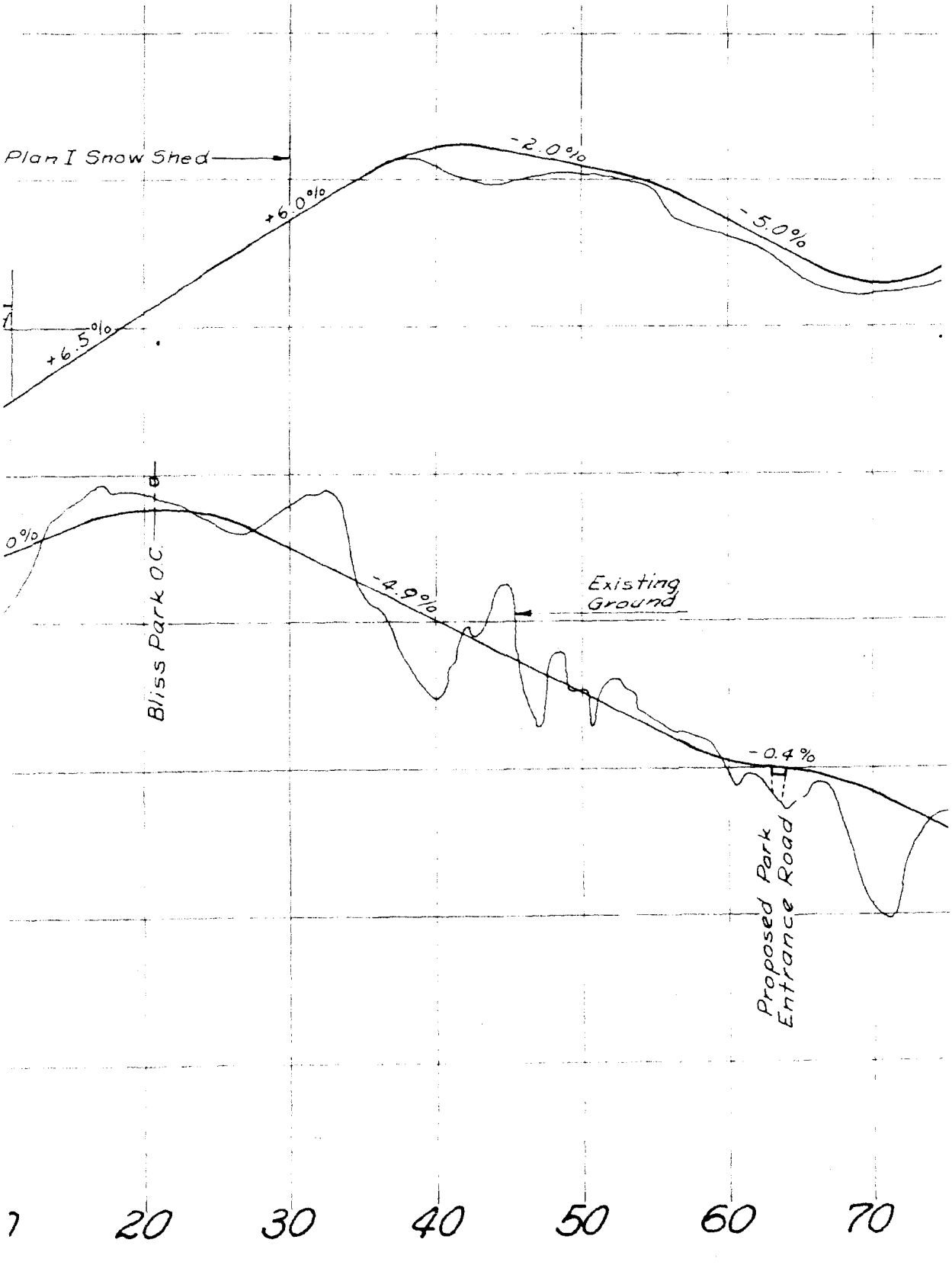
ALL WEATHER ROUTES

		Alternate A-1, A-2	Alternate B-1
Length		5.72	7.75
Estimated Average ADT 1965		2,525	2,525
Estimated Average ADT 1985		5,650	5,650
Summer ADT 1959		3,600	
Total Cost	(A-1)	$5,700,000	$8,625,000
	(A-2)	6,965,000	
Number of Curves Required		16	34
Total Degree of Curvature		635°	1,308°
Minimum Radius of Curve		900'	500'
Grades			
3% and Under		17,700 L.F.	12,300 L.F.
3% to 5%		7,990 L.F.	2,250 L.F.
5% to 6%		4,600 L.F.	2,300 L.F.
6%		0 L.F.	20,044 L.F.
Over 6%		0 L.F.	4,000 L.F.

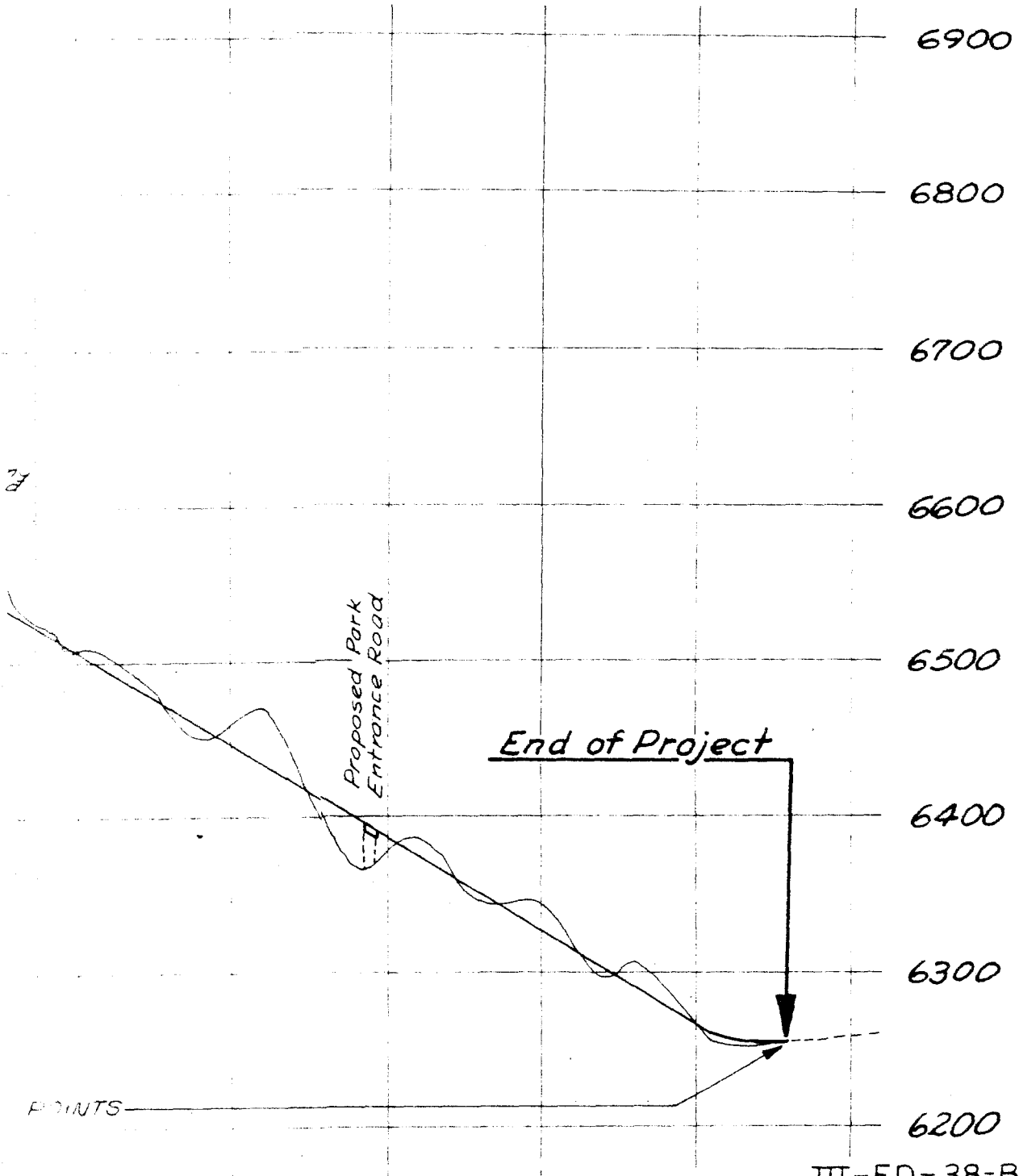

6900
6800
6700
6600
Beginning of Project
6500
6400
6300
6200
+4.8 %
+3.2 %
+5.5 %
+0.4 %
+1.2 %
100
10
20
30
40
50


Existing Ground
Emerald Bay Park O.C.
Cascade Creek
+6.0%
-4%
Emerald Bay Bridge
-0.2%
E.W.
E.W.
ALTERNATE "A"
ALTERNATE "A1"
PROFILE
Existing Ground
-1.5%
+1.0%
-1.5%
+1.0%
Cascade Creek
E.W.
E.W.
Emerald
Bay Bridge
State Park
Separation
60
70
80
90
200
10
20
30


BAY VIEW REST
+2.5%
Emerald Bay Tunnel
Snow Shed
-7.0%
Eagle Falls Creek
+0.4%
-6.0%
+6.0%
+4.0%
Plor
Snow
"B" PROFILE
+5.0%
+1.8%
+3.8%
ALTERNATE "A" PROFILE
40
50
60
70
80
90
300


Plan I Snow Shed
+6.0%
-2.0%
-5.0%
+6.5%
0%
Bliss Park OC
-4.9%
Existing Ground
-0.4%
Proposed Park Entrance Road
1
20
30
40
50
60
70

+5.0%
-0.5%
"B" Section
"C" Section
-6.0%
Existing Ground
End of Project
-5.0%
IDENTICAL P
80
90
400
10
20
30
40
50



III-ED-38-B,C

PROPOSED PROFILES

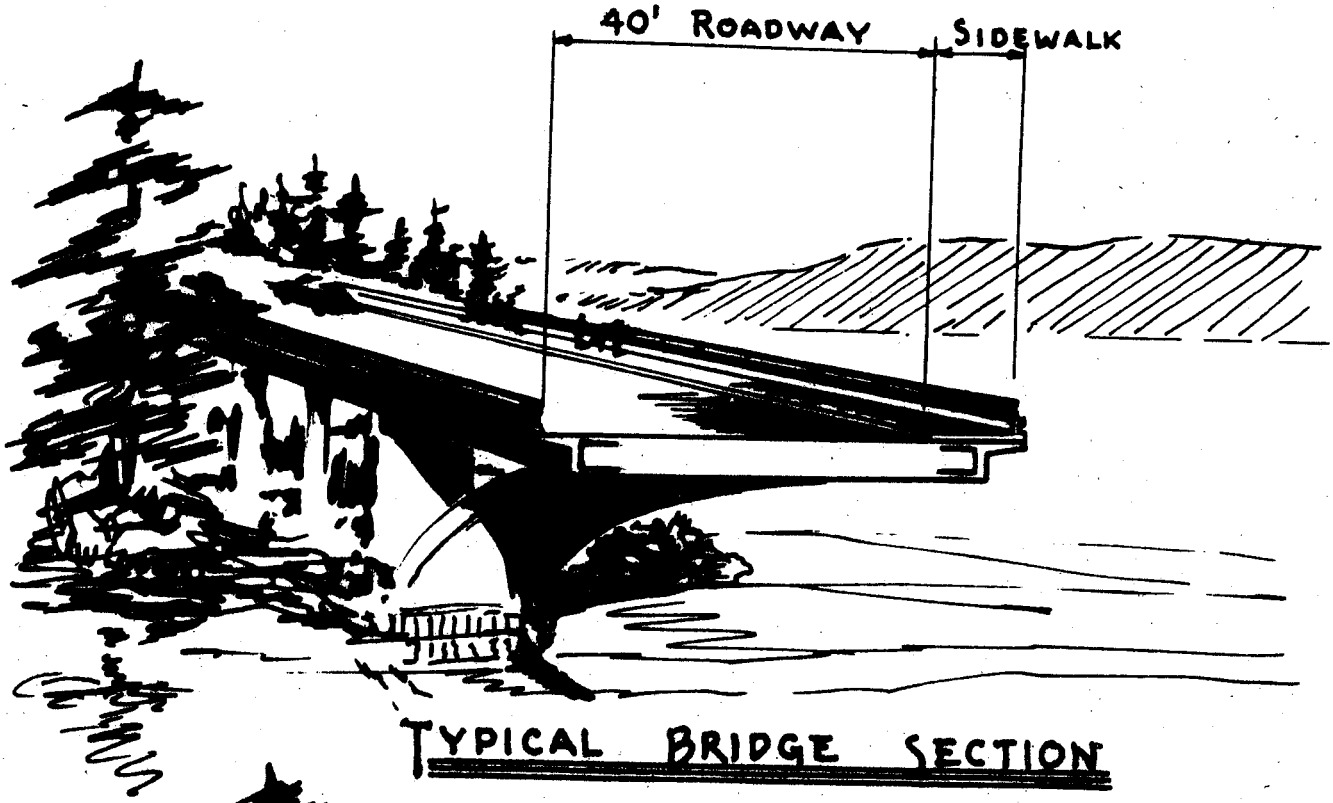
Between Tallac Creek and 0.5 Mile North of D.L. Bliss State Park

ALTERNATES "A", "A$_1$", "B"

Scale: 1"=1,000' Hor. September, 1960
1"=100' Vert.

PLATE M

"A" ALTERNATE (BRIDGE LINE)



TYPICAL BRIDGE SECTION

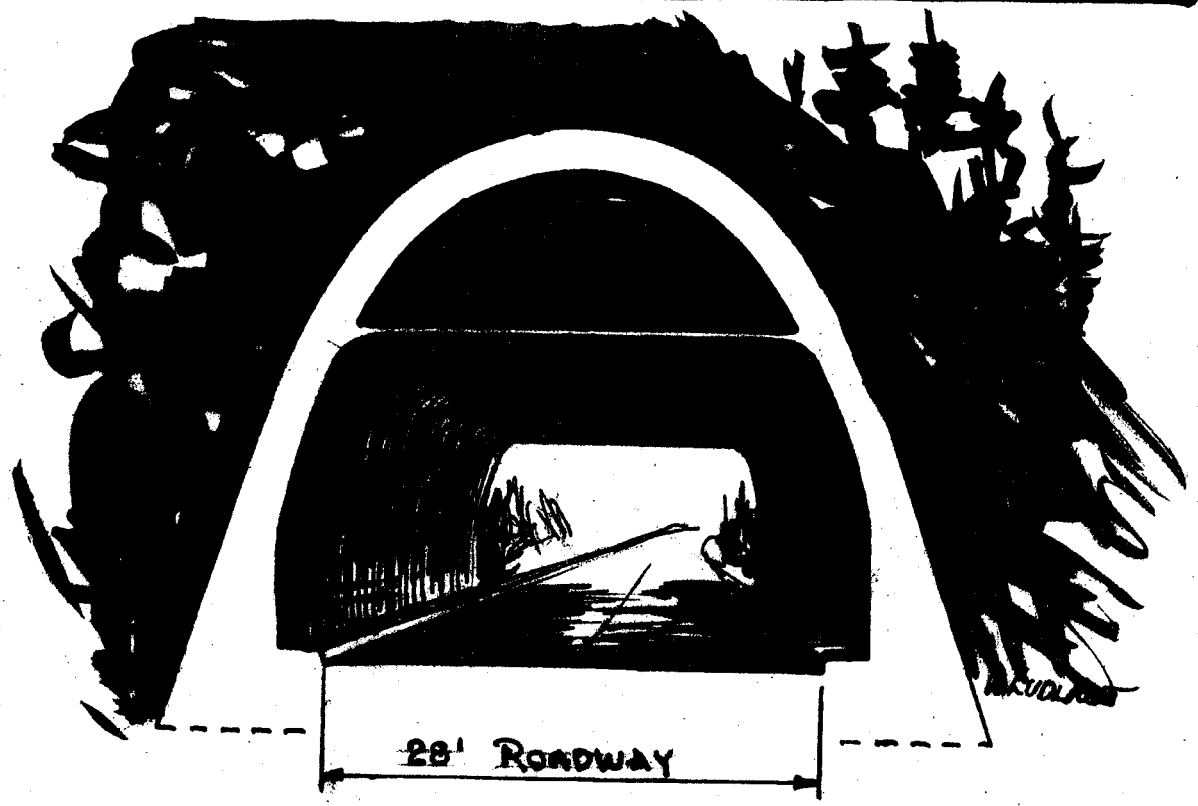


TYPICAL VIADUCT SECTION

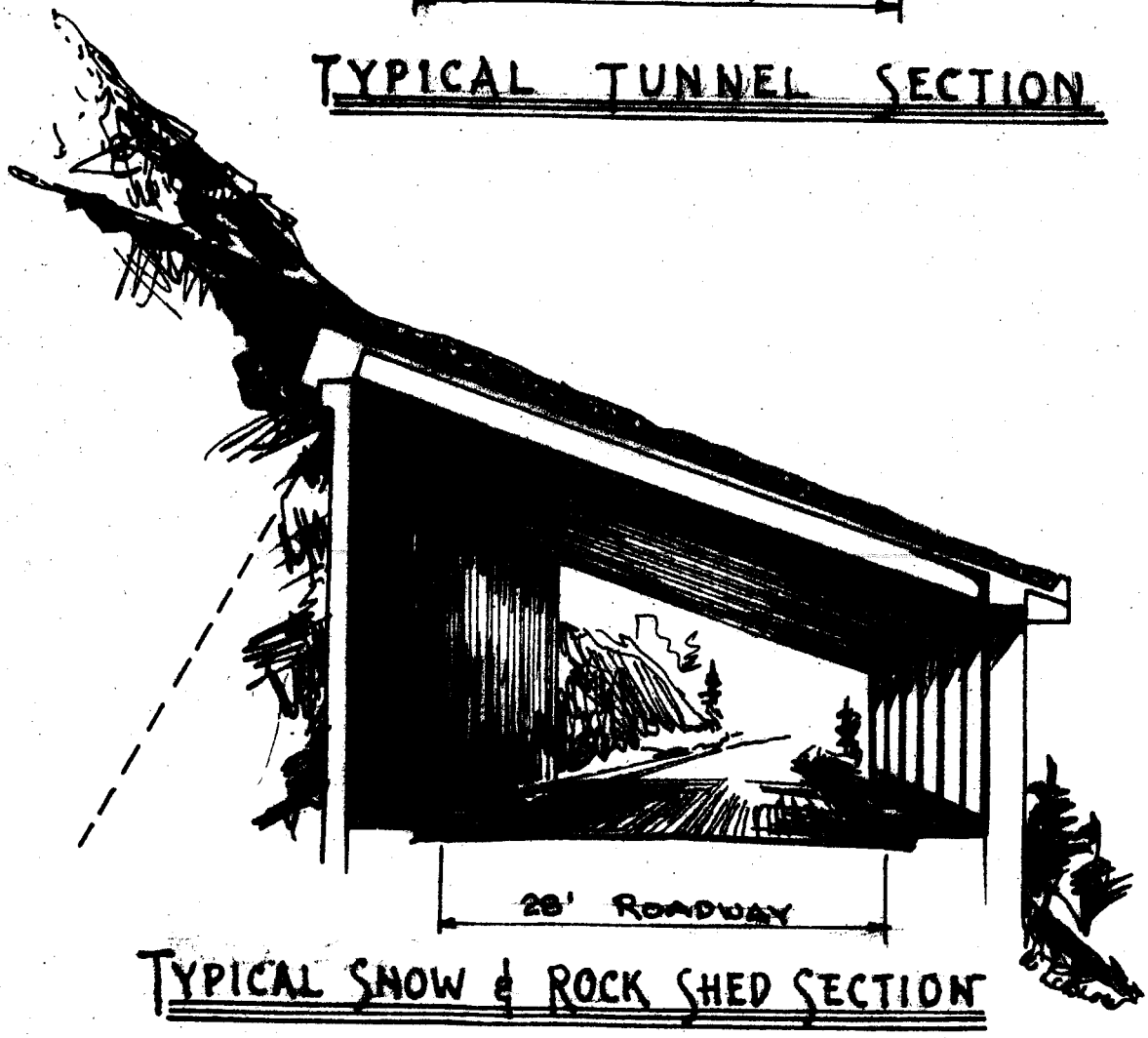
III-ED-38-B

EXHIBIT "N"

B ALTERNATE (EXISTING ROUTE)



TYPICAL TUNNEL SECTION



TYPICAL SNOW & ROCK SHED SECTION